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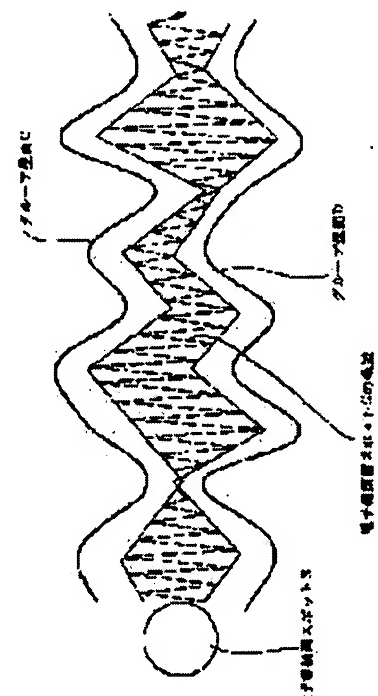
(71)Applicant : SONY CORP

(72)Inventor : MASUHARA SHIN
KOBAYASHI SEIJI

(54) METHOD FOR MANUFACTURING MASTER DISK FOR OPTICAL RECORDING MEDIUM, OPTICAL RECORDING MEDIUM AND APPARATUS FOR MANUFACTURING MASTER DISK FOR MANUFACTURING OPTICLA RECORDING MEDIUM



(57)Abstract:

PROBLEM TO BE SOLVED: To make the density of recording information of an optical recording medium higher.

SOLUTION: When the ruggedness patterns of grooves are formed by drawing with one electron beam, the electron beam is wobbled at a high velocity between the walls on both sides of the grooves to expose the grooves. The frequency fh of the high-velocity wobbling is specified to hf≥(2v/Lco) when the recording speed defined as v with respect to the detection threshold space length Lco=(λ/2 N.A.) of a reproduction optical system obtained when the reproducing wavelength of the optical recording medium manufactured from the master disk for manufacturing the optical recording medium is defined as λ and the numerical aperture of an objective lens as N.A.

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CLAIMS

[Claim(s)]
[Claim 1] The process which forms a sensitization agent layer on a base material, and the drawing process which draws this sensitization agent layer top with an electron ray, In the manufacture approach of the original recording for optical record-medium production which has the process which performs a development after this drawing process and forms the concavo-convex pattern of a groove at least on the above-mentioned sensitization agent layer In case the wall of the both sides of the above-mentioned groove is formed, the electron ray which exposes the above-mentioned sensitization agent and is used for drawing is made only into one. High-speed wobbling of this electron ray shall be carried out between the walls of the both sides of a groove, and the above-mentioned sensitization agent shall be exposed. The frequency fh of high-speed wobbling of this electron ray The playback wavelength of the optical record medium produced from the above-mentioned original recording for optical record-medium production lambda, The manufacture approach of the original recording for optical record-medium production characterized by being fh>= (2 v/Lco) when record linear velocity is set to v to limit-of-detection space length Lco= (lambda/2 N.A.) of the playback optical system acquired when numerical aperture of an objective lens is made into N.A.
[Claim 2] The wall of the both sides of the above-mentioned groove is the manufacture approach of the original recording for optical record-medium production according to claim 1 characterized by carrying out the wobble (it only being called a wobble forming in a meandering configuration, and the following) to the configuration where it became independent, respectively.
[Claim 3] It is the optical record medium which shall carry out the wobble to the configuration where are the optical record medium with which it comes to form the concavo-convex pattern of a groove on a substrate, and the wall of the both sides of the above-mentioned groove became independent, respectively, and is characterized by the track pitch of the above-mentioned groove being below 600 [nm].
[Claim 4] It shall be constituted by electron beam generating / focusing section and the device section. Electron beam generating / focusing section At least An electron gun, a condenser lens, and a blanking electrode and an aperture, It is constituted by a beam deflection electrode, the lens for focal adjustment, and the objective lens, and changes. The above-mentioned device section The spindle which lays the base material in which the sensitization agent layer was formed, and the above-mentioned base material It shall come to be constituted by the slide which makes movable a relative position with the electron-beam-irradiation section. To the above-mentioned beam deflection electrode It comes to prepare the high-speed wobbling signalling frequency generating means for carrying out wobbling of the electron ray. The frequency fh of high-speed wobbling of this electron ray When record linear velocity is set to v to limit-of-detection space length Lco= (lambda/2 N.A.) of the playback optical system acquired when numerical aperture of lambda and an objective lens is made into N.A. for the playback wavelength of the optical record medium produced from the original recording for optical record-medium production The manufacturing installation of the original recording for optical record-medium production characterized by being fh>= (2 v/Lco).

[Claim 5] The process which forms a sensitization agent layer on a base material, and the drawing process which draws this sensitization agent layer top with an electron ray, In the manufacture approach of the original recording for optical record-medium production which has the process which performs a development after this drawing process and forms the detailed irregularity pattern with which at least two kinds of width of face differs on the above-mentioned sensitization agent layer The electron ray which exposes the above-mentioned sensitization agent and is used for drawing is made only into one. The beam diameter of this electron ray The inside of the above-mentioned detailed irregularity pattern, It is made to make it in agreement with the width of face of a detailed irregularity pattern with the narrowest width of face. About drawing of a detailed irregularity pattern broader than the narrow detailed irregularity pattern of this maximum **** what is made to carry out high-speed wobbling of this electron ray between the walls of the above-mentioned detailed irregularity pattern both sides, and exposes the above-mentioned sensitization agent -- carrying out -- frequency fh2 of high-speed wobbling of this electron ray They are phi and record linear velocity about electron ray beam diameter half-value width v2 The manufacture approach of the original recording for optical record-medium production characterized by being fh2 >= (v2 / phi) when it carries out.
[Claim 6] The manufacture approach of the original recording for optical record-medium production according to claim 4 characterized by being fh 2>=100 [MHz].

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the manufacture approach of the original recording for optical record-medium production, an optical record medium, and the original recording manufacturing installation for optical record-medium production.
[0002]
[Description of the Prior Art] In recent years, the surface density which the demand to the formation of high density record of an optical record medium is increasing further, and serves as a development target in a next-generation optical record medium at present is more than 50 [Gbit/in2] that hits by 15 times the DVD (Digital Versatile Disc). In order to realize the optical record medium of such super-high density record, the reexamination of the present method which results to DVD is needed for the drawing approach of a detailed irregularity pattern at the time of producing the original recording for optical record-medium production, and the both sides of a record signal system which determine the detailed irregularity pattern drawn from CD (compact disk), and various new proposals are made.
[0003] How to draw a detailed irregularity pattern is explained to the original recording for optical record-medium production below.
[0004] In the optical disk 100 which is an example of an optical record medium, as shown in drawing 15 , the groove and pit train of a continuation groove are optically formed in the transparent one principal plane [of the disk substrate 101 made from plastics] 102, i.e., signal recording surface, side in the shape of a spiral by the predetermined track pitch P for every truck. The expansion perspective view of the groove 103 formed in drawing 16 at the signal recording surface 102 is shown, and the expansion perspective view of the pit 104 formed in drawing 17 at the signal recording surface 102 is shown.
[0005] The so-called writer bull optical disks, such as a recordable phase change mold or an optical MAG mold, have the configuration in which the phase change film or a magnetic film, the light reflex film, and a protective coat were formed on the field in which the groove was prepared. Moreover, optical disk only for playbacks (Read Only Disc) It is related and has the configuration in which the light reflex layer and the protective layer were formed on the field in which the train of a pit was prepared.
[0006] In performing signal regeneration from these optical disks, rotating an optical disk, with the signal recording surface 102 side of a substrate, the laser light from optical pickup is irradiated, the reflected light is read in the field side of the opposite side, and it performs signal regeneration. Moreover, in a recordable optical disk, information is written in a recording layer by the laser light from optical pickup, or reading of the information which wrote in the recording layer by the reflected light is made.
[0007] Furthermore, the reflected light from a groove is detected and tracking is performed so that the laser light for record or playback may always be irradiated on a desired truck. In the optical disk only for playbacks, informational reading and informational tracking are performed by detecting the reflection and the diffracted light from the signal recording surface which established the pit train to the exposure

light to a playback side.
[0008] As mentioned above, since it influences the engine performance as an information record medium, in case the pattern of the detailed irregularity formed in an optical disk substrate constitutes a substrate, it needs to form with high precision. Here, the production approach of the substrate of the optical record medium by which imprint production will be carried out the original recording for optical record-medium production known conventionally and from now on is explained.
[0009] In order to form detailed irregularity called the groove 103 and pit 104 of an optical disk, a photoresist layer is formed on a glass base material, and, generally the photolithography which exposes and develops this is applied.
[0010] First, as are shown in drawing 18 , and the base material 110 of the glass which ground the front face evenly and was washed is prepared, next it is shown in drawing 19 , the photoresist 111 used as alkali fusibility is applied to the thickness of 100 [nm] with a spin coat method by making it expose on a base material 110. Next, as shown in drawing 20 , predetermined is made to rotate the base material 110 with which the photoresist 111 was applied at a rotational frequency, the record laser light L which performed intensity modulation according to a record signal is condensed on a photoresist 111 with an objective lens 112, and it exposes to a predetermined pattern. At this time, a spiral-like latent image can be formed by moving the relative physical relationship of a base material 110 and an objective lens 112 to radial [of a base material 110].
[0011] Next, by developing the exposed photoresist 111, the exposed field can be dissolved and detailed irregularity structures, such as a groove 103 and a pit 104, can be formed. Some expansion perspective views of the base material when forming a groove 103 in drawing 21 are shown. Here, the crevice of the detailed irregularity when seeing from the field of a base material 110 and the opposite side is called a groove, and heights are called a land 113.
[0012] The original recording 117 for optical disk production by which the photoresist layer of a desired detailed irregularity pattern was formed on the base material 110 shown in drawing 22 as mentioned above is produced. Then, as shown in drawing 23 , for example, nickel deposit is given on the original recording 117 for optical disk production, this is exfoliated, and a stamper 115 is produced. The imprint of a detailed irregularity pattern is performed by injection molding, such as a polycarbonate, by using this stamper 115 as metal mold, for example, the substrate 120 for optical disks is produced. In case the reflective film and a protective coat are formed on this substrate 120 in case the optical disk only for playbacks is produced, and a recordable optical disk is produced, record film, the reflective film, and a protective coat can be formed, and the optical record medium made into the purpose can be produced.
[0013] By the request of the formation of super-high density record of the latest optical record medium, the shortest pit length can be formed in below 0.15[mum] extent by recording using the same EFM (Eight To Fourteen Modulation) signal as CD. In forming such a minute pit, an exposure spot needs to condense so that it may become magnitude equal to a pit as much as possible.
[0014] When condensing laser light, the diameter phi of an exposure spot is expressed as phi=(lambda/N.A.) depending on numerical-aperture N.A. of the wavelength lambda of light, and an objective lens. Although what is necessary is just to use by this two means of ** which enlarges (2) N.A. which shorten (1) lambda in order to make the diameter phi of an exposure spot small, in the present condition, these (1) and all of (2) have reached the limitation mostly, and it is becoming difficult to realize further high density record-ization.
[0015] Although short wavelength-ization to the 250 [nm] neighborhoods of an far-ultraviolet-rays field is considered in current about the wavelength of the light of (1), when attaining short wavelength-ization further, it is difficult to prepare the light source itself which carries out room temperature continuous oscillation. Moreover, about N.A. of (2), it is used in the place which already approached 1.0 of a theoretical upper limit community, and the room of improvement is not left behind as a matter of fact.
[0016] Since it mentioned above, it considers as the approach of obtaining the diameter of a spot small enough easily for the record application of the optical record medium of future high density record, and the design proposal of replacing laser light and exposing a resist with an electron ray is made. As a next-generation lithography technique of a semi-conductor, development is already furthered, and since

conventional mastering processes other than exposure can be used almost as it is also about the application to an optical disk, possibility that it will become the technique of a main stream exposing a resist with an electron ray in the near future is high.
[0017] Below, the electron-beam-lithography equipment 200 for optical disks by which the conventional proposal is made is explained with reference to drawing 24 .
[0018] The electron-beam-lithography equipment 200 shown in drawing 24 is constituted by electron beam generating / focusing section 201 of the upper part in a drawing, and the lower device section 202, and the whole equipment is laid on the shock absorbing desk 220 from which the extraneous vibration of an installation is removed. In addition, in the electron-beam-lithography equipment 200 shown in drawing 24 , the computer control equipment which performs control of the beam relation which controls turning on and off of an electron beam, adjustment of focusing beam size, the deviation (wobbling) of an electron beam, etc., and control of a device system shall have omitted the publication.
[0019] Electron beam generating / focusing section 201 is constituted by an electron gun 211, a condenser lens 212, a blanking electrode (beam modulation section) 213, the aperture 214, the beam deflection electrode 215, the lens 216 for focal adjustment, and the objective lens 217. for example, LaB6 etc. -- it is emitted from a thermoelectrical meridian gun, and the electron accelerated by the anode plate by several kV - 100kV converges by the condenser lens 212 which is an electrostatic lens, and reaches an aperture 214 through a blanking electrode 213. electrostatic **** after the electron beam extracted by the aperture 214 passes the beam deflection electrode 215 -- electromagnetism -- on the glass base material 110 to which the resist for electron rays was applied with the lens 216 for focal adjustment which is a mold lens, and the objective lens 217, it converges on a submicron spot size and a spot is irradiated.
[0020] The blanking electrode 213 of the upper part of an aperture 214 has the function made to turn an exposure electron beam on and off. When an electrical potential difference is impressed to blanking inter-electrode in fact, an electron beam will be deflected greatly, will separate from an aperture 214, and will be in an OFF state. Although the beam deflection electrode 215 also impresses an electrical potential difference and deflects an electron beam, this is for an exposure beam to deflect an electron beam from nm to mum order, namely, carry out wobbling on a resist side, with an ON state. An objective lens 217 converges the electron beam irradiated on a resist side, and is narrowed down to the spot of several micrometer size from several nm.
[0021] Next, the device section 202 has the configuration by which the spindle 218 which carries out chucking of the glass base material 110 to the upper part has been arranged on slide 219. A spindle 218 has it come with high precision to control a rotational frequency, and the rotational frequency is made according to the servo mechanism which used the optical rotary encoder as [control / by ten to seven or less / per one revolution / rotation jitter]. Moreover, slide 219 is a linear motor mold air slide, and delivery speed is controlled by the measuring machine style by the precision with the laser scale (not shown) with which the slide was equipped, and is made as [drive / to the original recording for optical disk production, i.e., radial / of a base material 110 /, / in the delivery precision of several nm]. The latent image of a groove or a pit is formed in the shape of a spiral, and concentric circular by the fixed track pitch by moving a record spot to radial the equal distance every per one revolution, rotating a base material 110.
[0022] If it collides with other electrons and other molecules, since electron beams will be scattered about and energy loss will be worn with breadth during propagation of an electron beam, the field which makes the electron beam in electron-beam-lithography equipment 200 spread is usually held at a high vacuum condition. That is, the ultra-high vacuum, about 217 objective lens, and the device section 202 of below 10-6[Pa] extent are held for electron beam generating / focusing section 201 [near the electron ray] at the degree of vacuum of below 10-3[Pa] extent.
[0023] The example which actually carried out mastering of the optical disk of high density record is announced from Pioneer Electronic Corp. by electron-beam-lithography equipment which was mentioned above (JAPANESE JOURNAL OF APPLIED PHYSICS/1998 year 4 moon / Vol.37 No.4 B/P.2137-2143/paper name "High Deneity Mastering Using Electron Beam"/author Yoshiaki Kojima et

al.). According to this, it has already succeeded in about 6.4 times (it is 30GB capacity =21 Gbit/in2 to CD one side considerable) as many pattern drawing as this with surface density to present [DVD]. This uses the same EFM signal as DVD, and has become shortest pit length =0.16micrometer and track pitch =0.29micrometer at this time. In addition, the diameter half-value width of a spot of an electron beam was 80nm.

[0024] On the other hand, by the conventional disk only for playbacks (ROM disk) represented by CD and DVD, information was recorded by forming through a detectable pit and a detectable mark optically about the record signal system. By detecting these pits or marks with an optical means, information is reproduced and the wave from which they were read by the optical pickup as an electrical signal is changed into the binary information on 1 or 0 by the judgment circuit. That is, although the wave of the analog called an "eye pattern" is acquired from an optical pickup, by comparing this with a predetermined threshold value, the double sign was carried out as information on binary, and it has restored to the original digital information. However, by carrying out the double sign of the wave from pickup to a multistage story recently, the multiple-value record which improves recording density further is proposed, and the thing of a completely different new concept from the conventional pit train pattern is contained in this.

[0025] There is a recording method called a baseband groove wobble record (it is hereafter described as GBR) method to one of them. In the wall of the both sides of a groove, i.e., drawing 25 , as it is indicated in drawing 25 as this GBR method, it is formed as a wave from which the groove wall A and the groove wall B change respectively in analog. And as the optical disk medium recorded by the GBR method is shown in drawing 26 , when the configuration of the groove wall A serves as a record signal of a wall surface A and the configuration of the groove wall B serves as a record signal of a wall surface B, the digital information of the multiple value of three or more values will be recorded, and, as for this digital information, a dc component is recorded as a repressed analog wave with the intersymbol interference between contiguous data. This analog wave is recorded on the medium as a variation rate of the groove wall recorded on the shape of a spiral, and concentric circular. That is, wobbling of the groove is carried out according to an analog-record signal, drawing not an intermittent pit but a continuous groove in the direction of a line, in case the original recording for optical record-medium production is exposed. The method which records information and mainly detects it from a push pull signal by wobbling of a groove at the time of playback is widely used for the object for mini discs, and the Lord for the address application of a recordable optical disc. However, by the GBR method, realizing recording density higher than the optical disk known conventionally for whether your being Haruka is considering as the purpose.

[0026] according to such a GBR method, solution of two problems of error generating by fluctuation of the dc component of a record signal and generating of the error by the intersymbol interference plans -- having -- **** -- in addition -- and record of high density is possible using the effective whole frequency domain. Furthermore, it makes it possible to have twice as many amount of information as this by the same track pitch as compared with the usual wobbling by carrying out wobbling of the wall of groove right and left according to an individual with the record signal which becomes independent. From the above thing, a GBR method makes it possible to realize recording density far higher than record by the conventional pit.

[0027] In order to carry out signal regeneration of the optical disk medium recorded by the GBR method mentioned above, there are two approaches. First, when the location of a groove or the wall surface of a mark displaces in analog, the 1st playback approach The disk media with which the multiple-value information restricted to the predetermined frequency band was recorded are made to condense a laser beam with an optical means. By irradiating as an optical spot for playback and detecting the laser beam by which the optical spot for playback was reflected or diffracted by the optical disk medium as an electrical signal The detection step which is the playback approach of the optical disk which reads the digital information recorded on the optical disk medium, and detects a tangential push pull signal, The integral step which integrates with this tangential push pull signal, The equalizer step which amends the frequency characteristics of a tangential push pull signal, and a quadrature amplitude modulation double

sign means or a QAM (Qaudratue Amplitude Modulation) double sign means is included.
[0028] It sets to the 2nd playback approach and playback is realized by polarization detection means to detect change of the polarization condition of the laser beam reflected or diffracted by the optical disk medium instead of a tangential push pull means.
[0029] two problems mentioned above also with the optical disk regenerative apparatus using which [of the above / 1st and 2nd] approach -- solving -- in addition -- and record playback of high density is possible using the effective whole frequency domain.
[0030]
[Problem(s) to be Solved by the Invention] As mentioned above, since an electron beam can fully be made detailed as compared with the optical spot by the conventional laser light, if this produces an optical record medium, fast high density record-ization will be attained. That is, it is thought by applying an electron beam to a GBR recording method that formation of the further detailed pattern is attained.
[0031] However, if it draws with an electron beam, there is a problem that exposure practically sufficient by the exposure approach equivalent to the conventional laser light cannot be performed.
[0032] In the GBR recording method shown and explained to drawing 25 and drawing 26 , when forming the wall of the both sides of a groove, wobbling of the spot of laser light is carried out according to an individual, and it is formed in a desired pattern independently, respectively. Namely, as shown in drawing 27 , an objective lens is minded for the 1st laser light 301 and the 2nd laser light 302. It irradiates on the base material 110 which applied the photoresist, and is two exposure spots S1 and S2. As a suitable distance for radial is set and installed and it is shown in drawing 2828 , taking care so that a part may lap mutually The groove of a desired configuration can be formed by exposing a photoresist, carrying out wobbling by the respectively independent record signal. That is, it sets to drawing 28 and is the exposure spot S1. Among drawing, it scans on the orbit shown with a broken line, a photoresist is exposed, the groove wall surface A is formed, and it is the exposure spot S2. It shall scan on the orbit shown with an alternate long and short dash line among drawing, a photoresist shall be exposed, and the groove wall surface B shall be formed. At this time, it is two exposure spots S1 and S2. If the amount of unexposed part generates and it approaches in the middle of the groove formed when separated too much too much conversely, since a contiguity beam does effect mutually and stops reflecting a record signal correctly at the time of spot wobbling, spacing needs to maintain these at suitable spacing and to scan them.
[0033] Here, the pattern detailed-ized limitation in the case of drawing a GBR format is considered using drawing 29 using the 2 beam laser exposing method mentioned above.
[0034] The minimum value of the groove width of face drawn by 1 beam laser is set to W, and, in both the cases of 2 beam laser, the amplitude which carries out wobbling is set to **deltaW. Since the desired amplitude will no longer be obtained if a spot intersects radial when carrying out wobbling independently by 2 beam laser, respectively, and the 2 beam spot approaches most, beam spacing is the 2deltaW need at least (condition with which two exposure spots lapped completely). At this time, the groove width of face Wd drawn with two beams by the condition of not giving wobbling is set to Wd=W+2deltaW (formula 1), and this value turns into the average of groove width of face.
[0035] In the GBR format, as shown in drawing 30 , it is required that one half of the pitches P of adjacent truck exposure (it considers as the average spacing although a truck lies in a zigzag line by wobbling) should be Wd. That is, it is set to Wd=P/2 (formula 2).
[0036] The value of the realistic truck spacing P is estimated to be below. Although it was the record optical system to which N.A.=0.90 of wavelength lambda= 266 [nm] and an objective lens can draw the present most detailed pattern when carrying out laser exposure, W of the minimum value of the groove width of face formed of this was W= 200 [nm] by the experiment. as mentioned above, these values can set to current laser exposure -- it is mostly considered the value of a limitation.
[0037] Moreover, in the GBR format, it is made appropriate to be about 10% of the track pitch P, for example, amplitude deltaW which carries out wobbling has estimated [that it is realizable with P=500 [nm] deltaW=50[nm] and] the surface density of 30 [Gbit/in2]. Therefore, as deltaW=0.1xP (formula 3), W= 200 [nm] was substituted, and by the above (formula 1), the (formula 2), and the (formula 3),

when solved about P, it was set to P= 666 [nm]. Although the optimum value of amplitude deltaW which carries out a wobble ring may have some increase and decrease if it actually experiments, as few as deltaW=50[nm], as an estimate, it is P= 600 [nm] and there is almost no implementability of a value smaller than this.
[0038] In the pitch P of an adjacent truck of the GBR format which can be formed being considered that 600 [nm] is a limitation by the 2 beam laser exposing method, and drawing the pattern of a pitch narrower than this, by the laser beam, it is unrealizable with the above consideration. However, it becomes producible [the pitch P of an adjacent truck / the detailed pitch 600 [nm]] by using an electron ray.
[0039] Now, also in electron-beam-lithography equipment, if drawing using two beams is possible like the laser beam used conventionally, it can respond to a GBR method with this. However, the formation of a multi-beam of an electron-beam-lithography method is very difficult technically. This reason is explained.
[0040] That is, even if there are two or more beam generation sources in the case of the electron-beam-lithography equipment 200 of a configuration as shown in drawing 24 , since the same electron optics system is passed, they cannot be modulated and (blanking actuation) deflected independently. then, a beam generation source -- namely, -- if it is completely made an independent electron optics system in this case until it results [from an electron gun 211] in an objective lens 217 -- electron-beam-lithography equipment 200 -- large-scale-izing -- it will complicate.
[0041] Since the array mold micro column drawing method which arranges two or more them in the shape of an array as an overall length 2.5 [mm] is proposed in order to solve it, and electronic acceleration voltage can impress [**] from an electron beam generation source to the objective lens 217 below to 1 [kV] per one column, there is a problem that the amount of dispersion after electronic resist incidence is large, and a beam cannot be extracted effectually. In addition to this, when two or more beams are used, practical problems, such as the homogeneity of the shape of beam and the original recording for mastering, i.e., the arrangement precision on a base material 110 etc., are expected that are large and there is considerable difficulty technically as compared with the handling of two or more conventional laser light.
[0042] Since it mentioned above, in order to realize the optical record medium of super-high surface density more than 50 [Gbit/in2], the new drawing approach of the aligner of the optical record medium using the electron ray which makes it possible to form the pattern of a GBR method by approaches other than two or more beams is needed.
[0043]
[Means for Solving the Problem] The manufacture approach of the original recording for optical record-medium production of this invention The process which forms a sensitization agent layer on a base material, and the process which draws a sensitization agent layer top with an electron ray, In case it has the process which performs a development after that and forms the detailed irregularity pattern of a groove at least on a sensitization agent layer and the wall of the both sides of a groove is formed, the electron ray which exposes a sensitization agent and is used for drawing is made only into one. High-speed wobbling of the electron ray shall be carried out between the walls of the both sides of a groove, and a sensitization agent shall be exposed. The frequency fh of high-speed wobbling of an electron ray When record linear velocity is set to v to limit-of-detection space length Lco= (lambda/2 N.A.) of the playback optical system acquired when numerical aperture of lambda and an objective lens is made into N.A. for the playback wavelength of the optical record medium produced from the original recording for optical record-medium production, it considers as fh>= (2 v/Lco).
[0044] As for the optical record medium of this invention, it shall come to form the detailed irregularity pattern of a groove on a substrate, and the track pitch of this groove carries out to below 600 [nm].
[0045] The manufacturing installation of the original recording for optical record-medium production of this invention It shall be constituted by electron beam generating / focusing section and the device section. Electron beam generating / focusing section At least An electron gun, a condenser lens, and a blanking electrode and an aperture, It shall come to be constituted by a beam deflection electrode, the

lens for focal adjustment, and the objective lens. The device section It shall come for the slide which makes movable a relative position with the electron-beam-irradiation section to constitute the spindle which lays the base material in which the sensitization agent layer was formed, and a base material. To a beam deflection electrode It comes to prepare the high-speed wobbling signalling frequency generating means for carrying out wobbling of the electron ray. The frequency fh of high-speed wobbling of this electron ray When record linear velocity is set to v to limit-of-detection space length Lco= (lambda/2 N.A.) of the playback optical system acquired when numerical aperture of lambda and an objective lens is made into N.A. for the playback wavelength of the optical record medium produced from the original recording for optical record-medium production, it shall be fh>= (2 v/Lco).

[0046] The manufacture approach of the original recording for optical record-medium production of this invention The process which forms a sensitization agent layer on a base material, and the drawing process which draws a sensitization agent layer top with an electron ray, It is what has the process which performs a development after a drawing process and forms the detailed irregularity pattern with which at least two kinds of width of face differs on a sensitization agent layer. In case the wall of the both sides of a groove is formed, the electron ray which exposes the above-mentioned sensitization agent and is used for drawing is made only into one. It is made to make the beam diameter of an electron ray in agreement with the width of face of a detailed irregularity pattern with the narrowest width of face among detailed irregularity patterns. About drawing of a detailed irregularity pattern broader than a detailed irregularity pattern with the narrowest width of face High-speed wobbling of the electron ray shall be carried out between the walls of the both sides of a groove, the above-mentioned sensitization agent shall be exposed, and it is the frequency fh2 of high-speed wobbling of an electron ray. They are phi and record linear velocity about electron ray beam diameter half-value width v2 When you carry out, suppose that it is fh2 >= (v2 / phi).

[0047] In the manufacture approach of the original recording for optical record-medium production of this invention, since one electron ray should be used, high-speed wobbling should be carried out between the walls of the both sides of a groove and the sensitization agent should be exposed when forming the wall of the both sides of a groove, it became possible to perform exposure which combined a conventional GBR method and electron beam lithography, and high density record-ization was attained as compared with the conventional original recording for optical record-medium production. The playback wavelength of the optical record medium produced from the original recording for optical record-medium production in the frequency fh of high-speed wobbling of this electron ray Furthermore, lambda, Since it was specified as fh>= (2 v/Lco) when record linear velocity was set to v to limit-of-detection space length Lco= (lambda/2 N.A.) of the playback optical system acquired when numerical aperture of an objective lens is made into N.A. The original recording for optical record-medium production which can perform signal regeneration of the optical record medium finally obtained good was offered.

[0048] In the manufacturing installation of the original recording for optical record-medium production of this invention, since it considered as the configuration which is made to discharge one electron ray from an electron gun, is made to carry out high-speed wobbling of this between the walls of the both sides of a groove, and exposes a sensitization agent when forming the wall of the both sides of a groove, the exposure which combined a conventional GBR method and electron beam lithography is attained.

[0049] Moreover, it sets to the manufacturing installation of the original recording for optical record-medium production of this invention. The playback wavelength of the optical record medium produced from the original recording for optical record-medium production in the frequency fh of high-speed wobbling of an electron ray lambda, When record linear velocity is set to v to limit-of-detection space length Lco= (lambda/2 N.A.) of the playback optical system acquired when numerical aperture of an objective lens is made into N.A. Since it considered as the configuration which established a high-speed wobbling frequency signal generation means to specify it as fh>= (2 v/Lco), signal regeneration of the optical record medium which imprints the original recording for optical record-medium production finally obtained, and is obtained can be performed good.

[0050] Moreover, it sets to the manufacture approach of the original recording for optical record-

medium production of this invention, and is the frequency fh2 of high-speed wobbling of an electron ray. They are phi and record linear velocity about electron ray beam diameter half-value width v2 When it carries out, By specifying that the relation of fh2 >= (v2 / phi) is materialized especially, it is made as [pass / over all the wall surfaces of the groove to form / a part or all of an exposure spot of an electron ray], and formation of the smooth groove of the shape of surface type of a wall is made.

[0051]

[Embodiment of the Invention] It outlines about the gestalt of the 1 operation about the manufacture approach of the original recording for optical record-medium production of this invention.

[0052] the base material top of the glass with which the manufacture approach of the original recording for optical record-medium production of this invention ground the front face -- for example, it has the process which forms the sensitization agent layer used as fusibility in a developer, the process which draw the predetermined field on this sensitization agent layer with an electron ray, and the process which perform a development after a drawing process and form the concavo-convex pattern of a groove at least on a sensitization agent layer by carrying out electron beam irradiation. And in case the wall of the both sides of a groove is formed, the electron ray which exposes a sensitization agent and is used for drawing is made only into one. High-speed wobbling of the electron ray shall be carried out between the walls of the both sides of a groove, and a sensitization agent shall be exposed. The frequency fh of high-speed wobbling of an electron ray When record linear velocity is set to v to limit-of-detection space length Lco= (lambda/2 N.A.) of the playback optical system acquired when numerical aperture of lambda and an objective lens is made into N.A. for the playback wavelength of the optical record medium produced from the original recording for optical record-medium production, it considers as fh>= (2 v/Lco).

[0053] Although imprint production of the optical record medium of this invention can be carried out, for example by the stamper of nickel metal which carried out imprint production by the original recording for optical record-medium production of above-mentioned this invention This for example, on the substrate which consists of transparent plastics to playback light, such as a polycarbonate It comes to form the concavo-convex pattern of a groove at least, the wobble of the wall of the both sides of this groove is carried out to the configuration where it became independent, respectively, and especially the track pitch of this groove is made below into 600 [nm].

[0054] The manufacturing installation of the original recording for optical record-medium production of this invention It shall be constituted by electron beam generating / focusing section and the device section. Electron beam generating / focusing section At least An electron gun, a condenser lens, and a blanking electrode and an aperture, It shall come to be constituted by a beam deflection electrode, the lens for focal adjustment, and the objective lens. The device section It shall come for the air slide which makes movable a relative position with the electron-beam-irradiation section to constitute the spindle which lays the base material in which the sensitization agent layer was formed, and a base material. To a beam deflection electrode It comes to prepare the high-speed wobbling signalling frequency generating means for carrying out wobbling of the electron ray. The frequency fh of high-speed wobbling of this electron ray When record linear velocity is set to v to limit-of-detection space length Lco= (lambda/2 N.A.) of the playback optical system acquired when numerical aperture of lambda and an objective lens is made into N.A. for the playback wavelength of the optical record medium produced from the original recording for optical record-medium production, it shall be fh>= (2 v/Lco).

[0055] With reference to drawing, the example is explained below, respectively with the manufacturing installation of the original recording for optical record-medium production for realizing this invention approach about the manufacture approach of the original recording for optical record-medium production of this invention. In addition, the optical record medium of this invention producible [with the manufacturing installation of the original recording for optical record-medium production of this invention, the original recording for optical record-medium production of this invention, and the original recording for optical record-medium production of this invention] is not limited to the example shown below.

[0056] First, as are shown in drawing 1 , and the base material 10 of the glass which ground the front

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face evenly and was washed is prepared, next it is shown in drawing 2 R> 2, the sensitization agent layer 11 which serves as fusibility to a developer on a base material 11 by electron beam irradiation is formed in predetermined thickness with a spin coat method.

[0057] Next, as shown in drawing 3 , predetermined is made to rotate the base material 10 with which the sensitization agent layer 11 was formed at a rotational frequency, with an objective lens 12, it condenses on the sensitization agent layer 11, and one electron ray B which performed intensity modulation according to a record signal is exposed to a predetermined pattern. At this time, the latent image of the shape of a desired spiral is formed by moving the relative physical relationship of a base material 10 and an objective lens 12 to radial [of a base material 10].

[0058] Next, by developing the exposed sensitization agent layer 11, the exposed field is dissolved and the groove G of a configuration as shown in drawing 4 is formed on a base material 10. especially the production approach of the original recording for optical record media of this invention is applied to the original recording for optical record media for producing the optical record medium applied to the recording method called a baseband groove wobble record (it is hereafter described as GBR) method -- a thing is carried out. In the wall of the both sides of Groove G, i.e., drawing 4 , this GBR method shall form the groove wall C and the groove wall D as a wave which changes respectively in analog, as shown in drawing 4 .

[0059] And as the optical record medium recorded by the GBR method is shown in drawing 5 , when the configuration of the groove wall C serves as a record signal of a wall surface C and the configuration of the groove wall D considers as the record signal of a wall surface D, the digital information of the multiple value of three or more values will be recorded, and a dc component records this digital information as a repressed analog wave with the intersymbol interference between contiguous data. This analog wave is recorded as a variation rate of the groove wall recorded by the shape of a spiral, and concentric circular on the medium.

[0060] In addition, although the wall of the both sides of the groove shown in drawing 4 and drawing 5 has the wobble configuration where it became independent, respectively, this invention is not limited to the groove wall of the configuration shown in this drawing 4 and drawing 5 , and if it applies about the groove of various configurations, such as what has the wobble configuration in which the configuration of the wall of both sides is common, and a thing in which one side has a straight-line configuration, it can be **(ed).

[0061] In the manufacture approach of the original recording for optical record-medium production of this invention, in case the original recording for optical record-medium production is exposed with an electron ray B, as shown in drawing 6 , high-speed wobbling of the one electron ray B is carried out on a frequency higher than a GBR record signal using the description of the electron ray in which hundreds of MHz ultra high-speed wobbling is possible. In the former, as drawing 28 was shown and explained, this changes by turns and exposes to coincidence the orbit which two laser exposure beams should pass by the location variation of respectively a request of the wall C of the both sides of Groove G, i.e., a groove wall surface, and the groove wall surface D.

[0062] After exposing as mentioned above, a development is performed and the original recording for optical record-medium production by which the desired detailed irregularity pattern was formed on the base material 10 is produced. Then, on this original recording for optical record-medium production, for example, nickel deposit is given, this is exfoliated, and a stamper is produced. The imprint of a detailed irregularity pattern is performed by injection molding, such as a polycarbonate, by using this stamper as metal mold, for example, the substrate for optical record media is produced. In case the reflective film and a protective coat are formed on this substrate in case the optical disk only for playbacks is produced, and a recordable optical disk is produced, record film, the reflective film, and a protective coat can be formed, and the optical record medium made into the purpose can be produced. Since this optical record medium was formed using one electron ray by high-speed wobbling which is a frequency higher than a GBR record signal, and exposes between the walls C and D of the both sides of a groove, further high density record-ization was realized rather than the conventional optical record medium, and it was confirmed that the track pitch P of a groove can be formed below in 600 [nm].

[0063] Next, in case a GBR pattern is drawn using one electron ray, while explaining the electron-beam-lithography equipment 20 to be used with reference to drawing, the frequency fh needed for the format and high-speed wobbling of a record signal at the time of drawing an electron ray B by high-speed wobbling to up to a base material is explained.
[0064] The electron-beam-lithography equipment 20 of this invention shown in drawing 7 is constituted by electron beam generating / focusing section 31 of the upper part in a drawing, and the lower device section 32, and is laid on the shock absorbing desk 33 from which the electron-beam-lithography equipment 20 whole removes the extraneous vibration of an installation. In addition, in the electron-beam-lithography equipment 20 shown in drawing 7 , the computer control equipment which performs control of the beam relation which controls turning on and off of electron beam B, adjustment of focusing beam size, the deviation (wobbling) of an electron beam, etc., and control of a device system shall have omitted the publication.
[0065] Electron beam generating / focusing section 31 is constituted by an electron gun 21, a condenser lens 22, a blanking electrode (beam modulation section) 23, the aperture 24, the beam deflection electrode 25, the lens 26 for focal adjustment, and the objective lens 27.
[0066] for example, LaB6 etc. -- it is emitted from the thermoelectrical meridian gun 21, and the electron accelerated by the anode plate by several kV - 100kV converges by the condenser lens 22 which is an electrostatic lens, and reaches an aperture 24 through a blanking electrode 23.
[0067] Electron beam B extracted by the aperture 24 is made as [occur / the signal for giving the frequency fh needed for this beam deflection electrode 25 in order that it may come to connect the high-speed wobbling signalling frequency generating means 40 and electron beam B may carry out high-speed wobbling from here], although the beam deflection electrode 25 is reached. About this frequency fh, it mentions later.
[0068] electron beam [after passing the beam deflection electrode 25] B -- electrostatic **** -- electromagnetism -- it is made as [irradiate / converge on the glass base material 10 to which the resist for electron rays was applied with the lens 26 for focal adjustment which is a mold lens, and the objective lens 27, and / a spot], and drawing which showed and explained drawing 6 on the base material 10 is performed.
[0069] Here, the blanking electrode 23 of the upper part of an aperture 24 has the function made to turn exposure electron beam B on and off. When an electrical potential difference is impressed to blanking inter-electrode in fact, electron beam B will be deflected greatly, and it will separate from it from an aperture 24, and it will be in an OFF state. An objective lens 27 converges electron beam B irradiated on the sensitization agent layer on a base material 10, and is narrowed down to a minute spot.
[0070] The device section 32 in drawing 7 has the configuration by which the spindle 28 which carries out chucking of the base material 10 to the upper part has been arranged on slide 29. A spindle 28 has it come with high precision to control an engine speed, and the engine speed is made according to the servo mechanism which used the optical rotary encoder as [control / by ten to seven or less / per one revolution / rotation jitter].
[0071] Moreover, slide 29 is a linear motor mold air slide, and delivery speed is controlled by the measuring machine style by the precision with the laser scale (not shown) with which the slide was equipped, and is made as [drive / to the original recording for optical disk production, i.e., radial / of a base material 10 /, / in the delivery precision of several nm]. The latent image of a groove or a pit can be formed in the shape of a spiral, and concentric circular by the fixed track pitch by moving a record spot to radial the equal distance every per one revolution, rotating a base material 10.
[0072] If it collides with other electrons and other molecules, since electron beams will be scattered about and energy loss will be worn with breadth during propagation of an electron beam, the field which makes the electron beam in electron-beam-lithography equipment 20 spread is usually held at a high vacuum condition. That is, the ultra-high vacuum, about 27 objective lens, and the device section 32 of below 10-6[Pa] extent are held for electron beam generating / focusing section 31 [near the electron ray] at the degree of vacuum of below 10-3[Pa] extent.
[0073] Next, the format of a record signal in the case of drawing a GBR pattern with one electron beam

mentioned above is explained using drawing 8 A and drawing 8 B.
[0074] Among two GBR record signals which give sinusoidal Sig-HFW=Esin for high-speed wobbling (2 pi-fh-t) (E: the amplitude, fh:frequency) to the wall of the both sides of the groove G to form, i.e., drawing 8 A, it considers as Sig-S which shows the composite signal superimposed on the negative forward electrical-potential-difference and electrical-potential-difference side, respectively to drawing 8 R>8B by Sig-GA and Sig-GB as shown in drawing 8 A. However, the amplitude core electrical potential difference of Sig-GA is set to +E, and it is the amplitude core electrical potential difference of Sig-GB. - It is referred to as E.
[0075] Next, the record signal for high-speed wobbling, i.e., the generation process of Sig-S, is explained with reference to drawing 9 . First, envelope amplitude deltaSig-G of Sig-S in the difference signal t of Sig-GA and Sig-GB, i.e., time of day, is obtained by the subtractor circuit. Next, product Sig-S2 with sin (2 pi-fh-t) which is the sin component of above-mentioned deltaSig-G and high-speed wobbling signal Sig-HFW by the counting circuit It obtains. Moreover, equalization of Sig-GA and Sig-GB is performed to coincidence, and Sig-OFT is generated. This expresses the amount of offset from a zero of the Sig-S envelope in the time of day t. Above-mentioned Sig-S2 Signal Sig-S finally inputted into a deflecting system drive circuit is generated by addition with Sig-OFT.
[0076] In addition, as a result of making it the above recording methods, in the point which the problem of generating for an unexposed part between 2 beams resulting from 2 beam-spot spacing made into a problem at the time of 2 beam exposure by laser light like before opening too much and the mutual intervention of a contiguity beam does not produce, this invention approach is excellent.
[0077] Moreover, although the GBR record signal was characterized by removing beforehand reading the signal of the wall of the intersymbol interference generated on the both sides at the time of pattern record and playback, i.e., the adjoining groove, exact reappearance to the nano meter order of spacing adjustment of two beams by the laser exposing method was very difficult for it, and, as a result, it cannot remove an intersymbol interference almost completely. On the other hand, in the exposure approach using one electron ray of this invention, since the repeatability in drawing is very excellent, removal of the intersymbol interference which is the advantage of a GBR method is realizable.
[0078] Next, in case high-speed wobbling by the electron ray which showed and explained drawing 6 about exposure of the groove of the original recording for optical record-medium production of this invention mentioned above is performed, the frequency fh needed is examined.
[0079] This frequency fh must be a value higher enough than the frequency of wobbling given to the groove itself, i.e., the wobbling frequency of a GBR record signal. Then, probably, if the GBR record signal fg is considered, the wobbling frequency will not exceed the optical limit of detection at the time of playback at the maximum. That is, it is because it will hang even over the signal with which the spot of read-out light adjoins and playback of an exact signal cannot be performed, if the wobbling frequency of a GBR record signal exceeds the optical limit of detection at the time of signal regeneration.
[0080] Here, the optical limit-of-detection (MTF (Modelation Transfer Fanction)) cut-off at the time of playback will be given by space length Lco=phi / 2, if the path of the spot of playback light is set to phi (at the time of playback wavelength =lambda and numerical-aperture =N.A. of an objective lens phi=lambda/N.A.). Since phi= 470 [nm] when being referred to as lambda=400[nm] N.A.=0.85 is the minimum value of phi when phi considered actually is considered, space length Lco=235[nm] is drawn from this.
[0081] in case the space length Lco is converted into record signal frequency, it must take into consideration that it is proportional to record linear velocity, but since the maximum of the record linear velocity of ************ right [that] ** is the estimate of 5 [m/s] extent, if it calculates from this figure, it will become maximum fg(max) =21[MHz] of record signal frequency.
[0082] here, generally it is known by the theorem of a sampling -- as -- a sampling frequency required at the time of playback -- at least 2 times of record signal frequency -- it is -- ****ing . Namely, what is necessary is to perform high-speed wobbling at the maximum fg (max) twice the frequency of record signal frequency, and just to record the location of a groove wall at the time of pattern drawing. When record linear velocity is set to v to limit-of-detection space length Lco= (lambda/2 N.A.) of the playback

optical system acquired when numerical aperture of lambda and an objective lens is made into N.A. for the playback wavelength of the optical record medium with which the frequency fh of high-speed wobbling of an electron ray is produced from the original recording for optical record-medium production from this, what is necessary is just fh>= (2 v/Lco).
[0083] Since it mentioned above, when maximum fg (max) of record signal frequency is set to 21 [MHz], there should just be a high-speed wobbling frequency fh at the time of performing electron beam lithography more than 42 [MHz].
[0084] However, the wall of the both sides of the groove which formed now by performing electron beam lithography in the frequency of above-mentioned minimum extent when it was set as the high-speed wobbling frequency fh is not formed smoothly, but there is a possibility that it may be ruined in the configuration where the front face is notched. The notched configuration formed in the wall of the both sides of a groove Since it is finely made to extent exceeding optical signal limit of detection in current In the signal regeneration of the optical record medium finally produced, although it has not been especially a problem, the optical record medium produced using the original recording for optical record-medium production is set in the future. When performing signal detection with the diameter of a playback light spot smaller than current, there is a possibility of becoming a problem.
[0085] Moreover, if ruined, it will also be considered that it becomes difficult for reflective film, record film, etc. which are formed in a groove front face to form membranes in the good condition, and it causes [of a noise] generating in the case of signal regeneration. Since it mentioned above, as for the configuration of the wall of the both sides of a groove, forming smoothly is desirable. Hereafter, it explains with reference to drawing.
[0086] In order to smooth the shape of surface type of the wall of the both sides of a groove The space length period Lh in high-speed wobbling according to an electron ray as shown in drawing 10 , Namely, the exposure spot on the single-sided wall surface of a groove exposes the wall surface of one of other grooves by high-speed wobbling. Things are understood that the distance Lh which is a round term until it returns to the wall surface of the original groove again, and a spot moves to a tangential direction should just be below the half-value width phi of the beam diameter of an electron ray experientially.
[0087] That is, it is the record linear velocity of an electron ray v2 It carries out and is the frequency of high-speed wobbling of an electron ray fh2 When it carries out and half-value width of the path of an electron ray beam is set to phi, By it being required to be referred to as space length period Lh=(v2 / fh2) <=phi in high-speed wobbling by the electron ray, and doing in this way In the case of high-speed wobbling, a part or all of an exposure spot of an electron ray passes over all the wall surfaces of a groove, exposure is made so that exposure may smear away the required range by sufficient exposure reinforcement, and as shown in drawing 11 , the shape of surface type of the wall of a groove is formed smoothly.
[0088] The space length period Lh in high-speed wobbling according to an electron ray as another side is shown in drawing 12 , Namely, the exposure spot on the single-sided wall surface of a groove exposes the wall surface of one of other grooves by high-speed wobbling. If the distance Lh which is a round term until it returns to the wall surface of the original groove again, and a spot moves to a tangential direction is larger than the half-value width phi of the beam diameter of an electron ray Since the exposure spot of an electron ray cannot pass all the wall surfaces of a groove and cannot fully expose the range to be exposed in the case of high-speed wobbling, as shown in drawing 13 , the shape of surface type of the wall of a groove will become notch-like.
[0089] Here, an example is given and explained. For example, although record wavelength was set to lambda= 351 [nm] and it was phi= 240 [nm] at the time of numerical-aperture N.A.=0.90 of an objective lens, as a result of actually experimenting, when the groove of the wall of a front face smooth at below Lh=200 [nm] was formed and it carried out to more than Lh=250 [nm], it was confirmed that a notch sticks and is ruined on the front face of the wall of the both sides of a groove. Although half-value width phi of an electron ray beam diameter can be made small to a minimum of 50 [nm] extent in current, when it was set as space length period Lh=50[nm] in high-speed wobbling by the electron ray and record linear velocity sets to 5 [m/s], it becomes high-speed wobbling frequency fh=100[MHz]. As for

the above thing to the high-speed wobbling frequency fh, it is desirable to set up more than 100 [MHz].
[0090] In the manufacture approach of the original recording for optical record-medium optical record-medium production of this invention mentioned above, and the example of the original recording manufacturing installation for optical record-medium production, a GBR method is applied, and although the case where it exposed by electron beam irradiation was explained, this invention is not limited to the example mentioned above. That is, if the wall of the both sides of the groove formed by exposure is the independent optical record medium which carries out wobbling (meandering), it is applicable similarly about the optical record medium which has other formats.
[0091] Moreover, although it thinks as an address signal application of a mainly recordable optical disk, for example as the address insertion approach of a land / groove record format, a signal is recorded only on one side by wobbling among the walls of the both sides of a groove, and "the single-sided wobble method" proposed shares it by the land and the groove. In this "single-sided wobble method", since the wall of one side serves as a straight-line configuration, in the above, one side (for example, Sig-GB) of record signal Sig-S shown and explained to drawing 8 A is made a direct current (DC).
[0092] Moreover, also in case the groove of a straight-line configuration or the groove to which the wall of the both sides of a groove is aligned with and wobbling is carried out is drawn, when forming width of face thicker than the diameter of an exposure spot, the technique of high-speed wobbling mentioned above is useful.
[0093] For example, as shown in drawing 14 , when it has the configuration in which a groove is interrupted for the address format of a recordable optical disk, and the address pit is inserted, generally, the optimum values of pit width of face and groove width of face differ, and must distinguish and form such magnitude. Although to adjust an input signal electrical-potential-difference value independently in a groove part and a pit part, respectively, and to control each exposure reinforcement by the conventional laser exposure the optimal has been needed when drawing this with one electron ray In exposing by high-speed wobbling using an electron ray As shown in drawing 14 , it adjusts so that the diameter of a spot of an electron ray may be doubled with width of face with the thinner width of face among a groove or a pit (usually pit), and suppose that the part with thicker width of face (usually groove) is exposed by high-speed wobbling mentioned above. In this case, frequency fh2 of high-speed wobbling of an electron ray They are phi and record linear velocity about the half-value width of the beam diameter of an electron ray v2 When it carries out, It adjusts so that it may become fh2 >= (v2 / phi), and by the drawing locus, as the whole width of face is smeared away, it shall be exposed. The one where width of face is thinner By exposing, the shape of surface type of the wall of the groove which formed in the width of face of a request of the both sides of a groove and a pit, and carried out exposure formation by high-speed wobbling can be smoothly formed by drawing in the shape of a straight line. Therefore, it became possible by being able to expose different width of face by the scan of one electron ray, and controlling the frequency of wobbling of an electron ray to perform signal regeneration of the optical record medium which can be imprinted and produced from the original recording for optical record-medium production finally obtained in the good condition.
[0094]
[Effect of the Invention] In the manufacture approach of the original recording for optical record-medium production of this invention Since one electron ray shall be used, high-speed wobbling shall be carried out between the walls of the both sides of a groove and a sensitization agent shall be exposed in case the wall of the both sides of a groove is formed The instability of the beam spacing repeatability for every exposure at the time of exposing by two laser beams conventionally is avoidable. Moreover, it is avoidable that problems, such as generating of the gap from the right groove wall location by the mutual intervention between two exposure spots, arise. pattern record which is the description of a GBR method, and intersymbol-interference removal at the time of playback could be realized effectively, and high density record-ization of the original recording for final profit **** optical record-medium production was able to be attained.
[0095] Moreover, it sets to the manufacture approach of the original recording for optical record-medium production of this invention. The playback wavelength of the optical record medium produced

from the original recording for optical record-medium production in the frequency fh of high-speed wobbling of an electron ray lambda, Since it was specified as fh>= (2 v/Lco) when record linear velocity was set to v to limit-of-detection space length Lco= (lambda/2 N.A.) of the playback optical system acquired when numerical aperture of an objective lens is made into N.A. The original recording for optical record-medium production which can perform signal regeneration of the optical record medium finally obtained good was able to be offered.

[0096] In the optical record medium of this invention, since it considered as the configuration which has the groove of a track pitch more detailed than the conventional optical record medium, rather than the conventional optical record medium, high density record-ization was attained and the mass optical record medium has been realized.

[0097] In the manufacturing installation of the original recording for optical record-medium production of this invention Since it considered as the configuration which is made to discharge one electron ray from an electron gun, is made to carry out high-speed wobbling of this between the walls of the both sides of a groove, and exposes a sensitization agent when forming the wall of the both sides of a groove The exposure which combined a conventional GBR method and electron beam lithography was attained, it came to be able to perform formation of a detailed groove pattern, and high density record-ization of the original recording for optical record-medium production was able to be attained.

[0098] Moreover, it sets to the manufacturing installation of the original recording for optical record-medium production of this invention. The playback wavelength of the optical record medium produced from the original recording for optical record-medium production in the frequency fh of high-speed wobbling of an electron ray lambda, When record linear velocity is set to v to limit-of-detection space length Lco= (lambda/2 N.A.) of the playback optical system acquired when numerical aperture of an objective lens is made into N.A. Since it considered as the configuration which established a high-speed wobbling frequency signal generation means to specify it as fh>= (2 v/Lco), signal regeneration of the optical record medium which imprints the original recording for optical record-medium production finally obtained, and is obtained could be performed good.

[0099] Moreover, it sets to other invention of the manufacture approach of the original recording for optical record-medium production of this invention of 1. A groove is interrupted for the address format of a recordable optical disk. When it has the configuration in which the address pit is inserted, the inside of a groove or a pit, It adjusts so that the diameter of a spot of an electron ray may be doubled with width of face with thinner width of face (usually pit). The part with thicker width of face (usually groove) It supposes that it exposes by high-speed wobbling mentioned above, and is the frequency fh2 of high-speed wobbling of an electron ray. They are phi and record linear velocity about the half-value width of the beam diameter of an electron ray v2 When it carries out, Since it adjusted so that it might become fh2 >= (v2/phi), it should be exposed by the electron-beam-lithography locus as the whole width of face of a groove was smeared away, and the one where width of face is thinner was exposed by drawing in the shape of a straight line, the both sides of a groove and a pit were able to be exposed to desired width of face. It became possible by being able to expose different width of face by the scan of one electron ray by this, and controlling the frequency of wobbling of an electron ray to perform signal regeneration of the optical record medium which can be imprinted and produced from the original recording for optical record-medium production finally obtained in the good condition.

[0100] Moreover, it sets to the manufacture approach of the original recording for optical record-medium production of this invention, and is the frequency fh2 of high-speed wobbling of an electron ray. They are phi and record linear velocity about electron ray beam diameter half-value width v2 When it carries out, By specifying that the relation of fh2 >= (v2 / phi) is materialized especially, it was made as [pass / over all the wall surfaces of the groove to form / a part or all of an exposure spot of an electron ray], and formation of the smooth groove of the shape of surface type of a wall was made.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Process drawing of an example of the manufacture approach of the original recording for optical record-medium production of this invention is shown.
[Drawing 2] Process drawing of an example of the manufacture approach of the original recording for optical record-medium production of this invention is shown.
[Drawing 3] Process drawing of an example of the manufacture approach of the original recording for optical record-medium production of this invention is shown.
[Drawing 4] The outline top view of the groove which can be formed in the manufacture approach of the original recording for optical record-medium production of this invention is shown.
[Drawing 5] The mimetic diagram of a record signal with the wall of the both sides of the groove formed with the GBR method is shown.
[Drawing 6] The outline top view of the orbit of the spot of the electron beam lithography in the manufacture approach of the original recording for optical record-medium production of this invention is shown.
[Drawing 7] The schematic diagram of the electron-beam-lithography equipment which is a manufacturing installation of the original recording for optical record-medium production of this invention is shown.
[Drawing 8] A The outline state diagram of the GBR record signal given to the wall of the sine wave for high-speed wobbling of an electron beam and the both sides of a groove in the manufacture approach of the original recording for optical record-medium production of this invention is shown. B The outline state diagram of the composite signal for high-speed wobbling in the manufacture approach of the original recording for optical record-medium production of this invention is shown.
[Drawing 9] The generation process Fig. of the record signal for high-speed wobbling of the electron beam in the manufacture approach of the original recording for optical record-medium production of this invention is shown.
[Drawing 10] The space length period Lh by high-speed wobbling, relation with the half-value width phi of an electron ray beam diameter, and the schematic diagram of the migration condition of an exposure spot are shown.
[Drawing 11] The schematic diagram of the shape of surface type of a groove wall is shown.
[Drawing 12] The space length period Lh by high-speed wobbling, relation with the half-value width phi of an electron ray beam diameter, and the schematic diagram of the migration condition of an exposure spot are shown.
[Drawing 13] The schematic diagram of the shape of surface type of a groove wall is shown.
[Drawing 14] The state diagram of the groove which can be formed by high-speed wobbling of an electron beam, and a pit in the manufacture approach of the original recording for optical record-medium production of this invention is shown.
[Drawing 15] The outline perspective view of the optical disk of structure is shown conventionally.
[Drawing 16] It is the enlarged drawing of the signal recording surface of an optical disk, and the outline

perspective view of a groove is shown.
[Drawing 17] It is the enlarged drawing of the signal recording surface of an optical disk, and the outline perspective view of a pit is shown.
[Drawing 18] The making process Fig. of the conventional original recording for optical disk production and the substrate for optical disks is shown.
[Drawing 19] The making process Fig. of the conventional original recording for optical disk production and the substrate for optical disks is shown.
[Drawing 20] The making process Fig. of the conventional original recording for optical disk production and the substrate for optical disks is shown.
[Drawing 21] The making process Fig. of the conventional original recording for optical disk production and the substrate for optical disks is shown.
[Drawing 22] The making process Fig. of the conventional original recording for optical disk production and the substrate for optical disks is shown.
[Drawing 23] The making process Fig. of the conventional original recording for optical disk production and the substrate for optical disks is shown.
[Drawing 24] The outline block diagram of an example of electron-beam-lithography equipment is shown.
[Drawing 25] The schematic diagram of the groove of the optical record medium by the GBR method is shown.
[Drawing 26] The mimetic diagram of a record signal with the wall of the both sides of the groove of the optical record medium by the GBR method is shown.
[Drawing 27] The outline state diagram when exposing a photoresist with the application of two laser exposure spots is shown.
[Drawing 28] The schematic diagram of the groove wall surface formed in the scan orbit and each of each exposure-spot when performing laser exposure of the GBR format by two beams is shown.
[Drawing 29] The state diagram of the distance between the spots at the time of the two beam spots performing laser exposure is shown.
[Drawing 30] The schematic diagram of the relation between average truck spacing in a GBR format and the average groove width of face Wd is shown.
[Description of Notations]
10 Base Material, 11 Photoresist, 12 Objective Lens, 20 Electron-Beam-Lithography Equipment, 21 An electron gun, 22 A condenser lens, 23 Blanking electrode, 24 An aperture, 25 A beam deflection electrode, 26 The lens for focal adjustment, 27 An objective lens, 28 A spindle, 29 A slide, 31 Electron beam generating / focusing section, 32 The device section, 33 A shock absorbing desk, 40 High-speed wobbling frequency signal generation means, 100 An optical disk, 101 A substrate, 102 A signal recording surface, 103 Groove, 104 A pit, 110 A base material, 111 Photoresist, 112 An objective lens, 113 A land, 115 nickel deposit, 117 The original recording for optical disk production, 120 A disk substrate, 200 Electron-beam-lithography equipment, 201 Electron beam generating / focusing section, 202 The device section, 211 Electron gun, 212 A condenser lens, 213 A blanking electrode, 214 apertures, 215 A beam deflection means and 216 The lens for focal adjustment, and 217 An objective lens and 218 A spindle and 219 An air slide and 220 A shock absorbing desk and 301 the 1st laser light and 302 -- 2nd laser light

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[Translation done.]

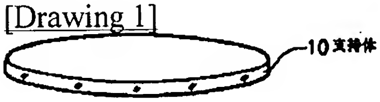
* NOTICES *

JPO and NCIPI are not responsible for any
damages caused by the use of this translation.

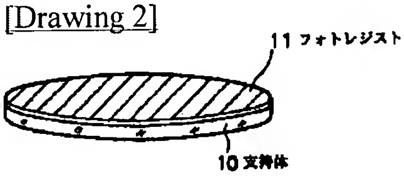
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]



[Drawing 2]



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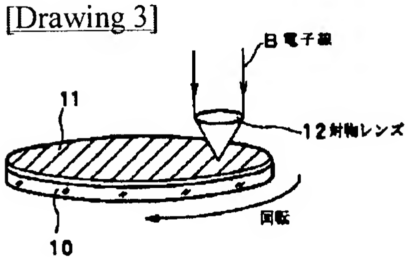

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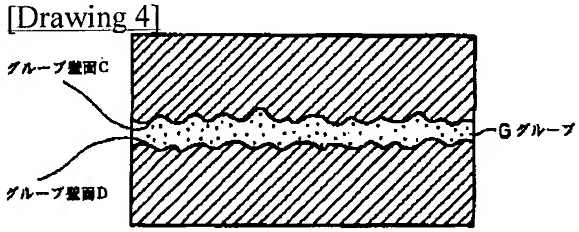

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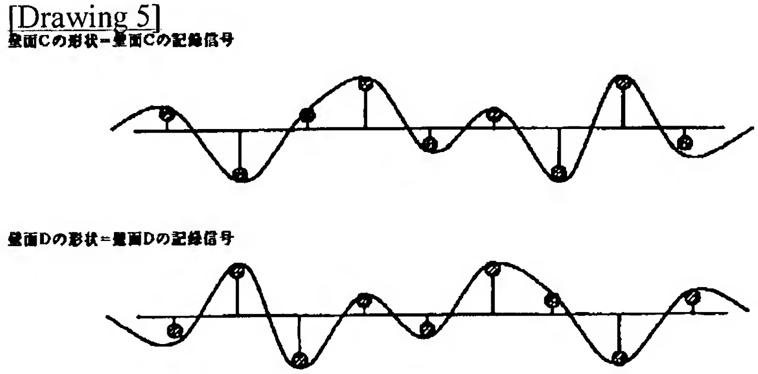

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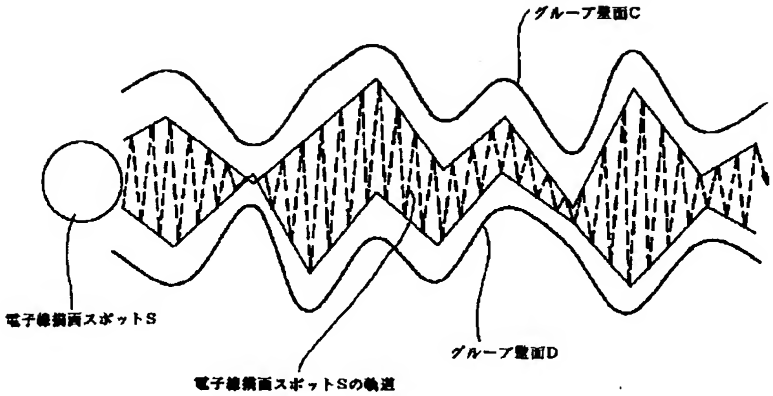

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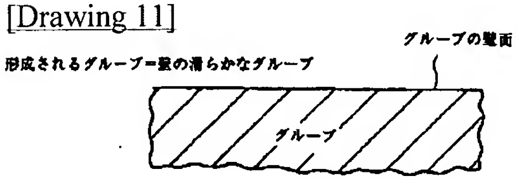
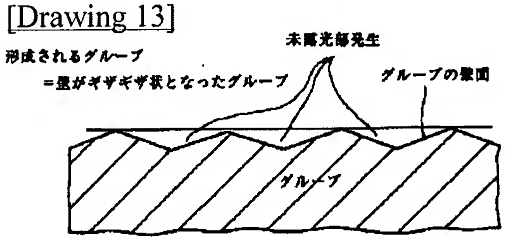


[Drawing 13]



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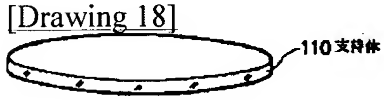

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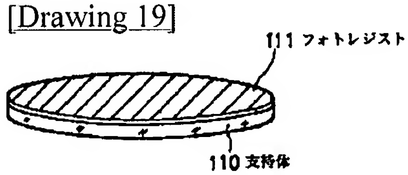

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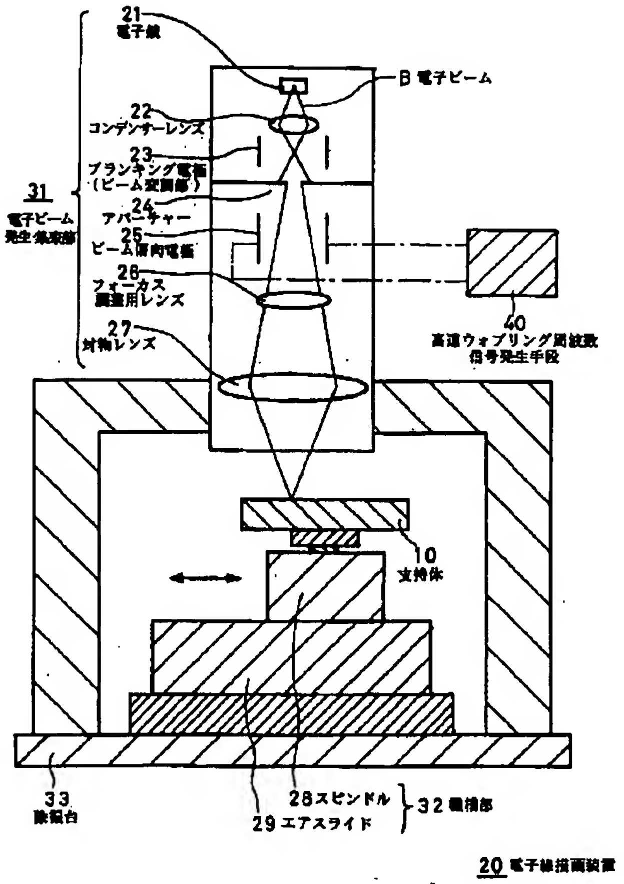

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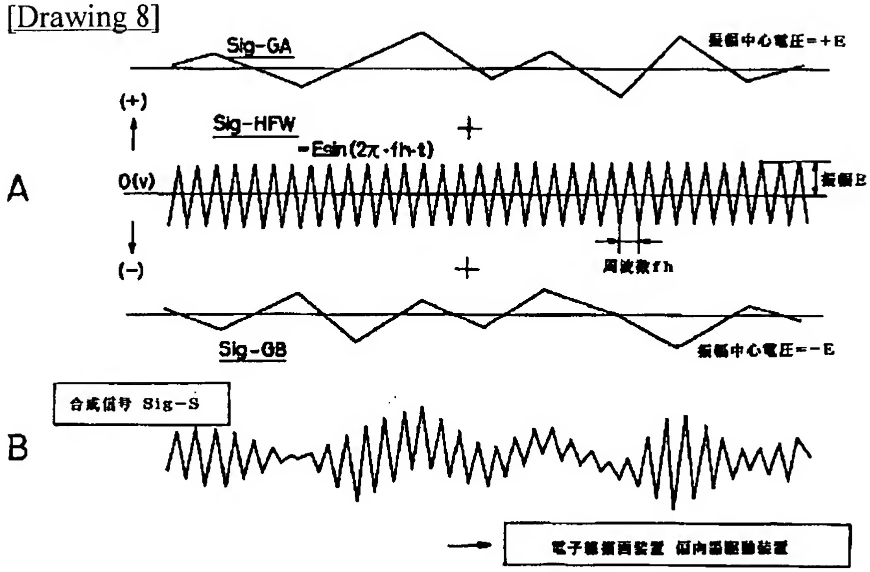

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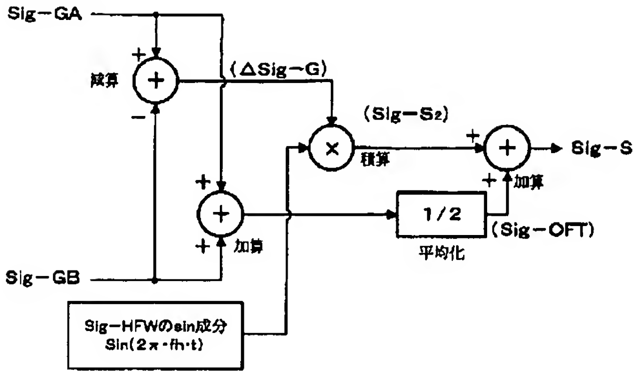

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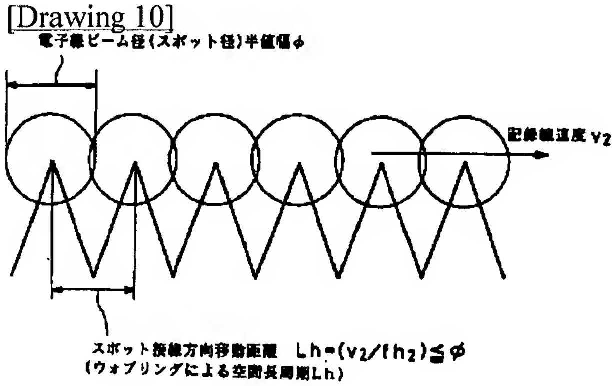

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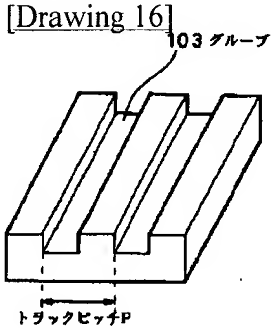

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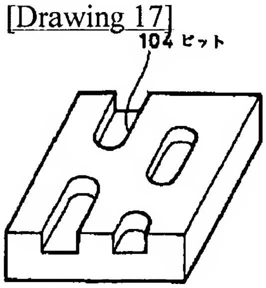

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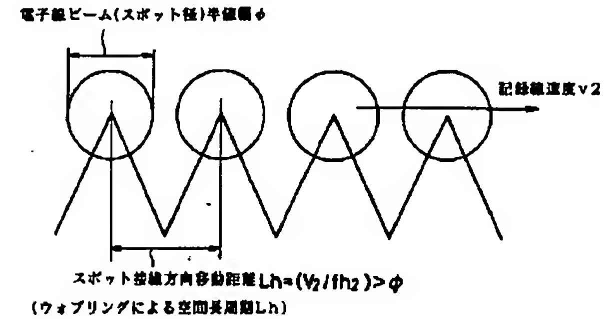

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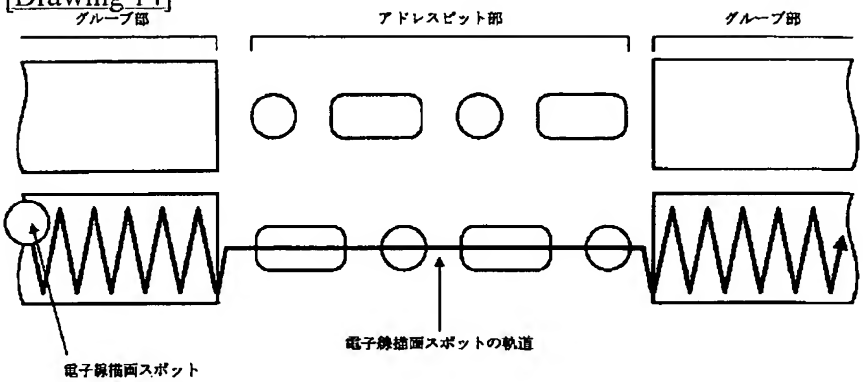

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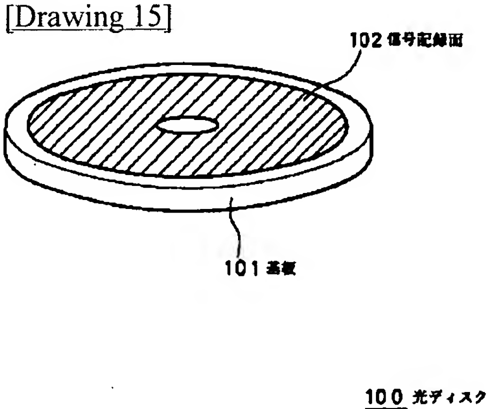

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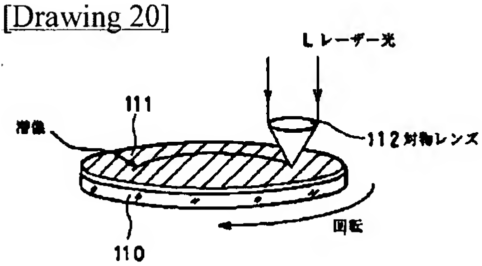

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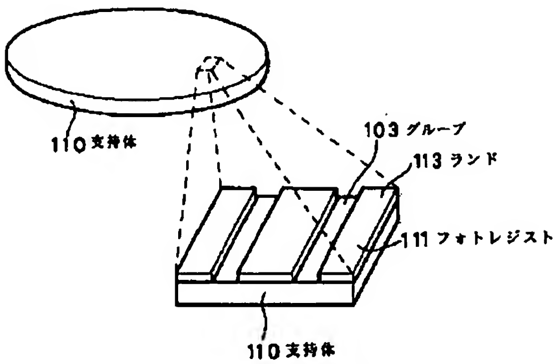

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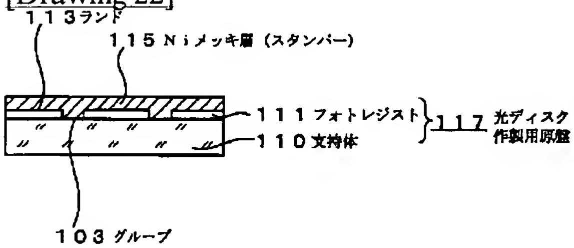

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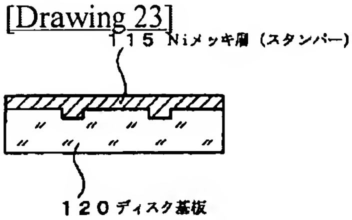

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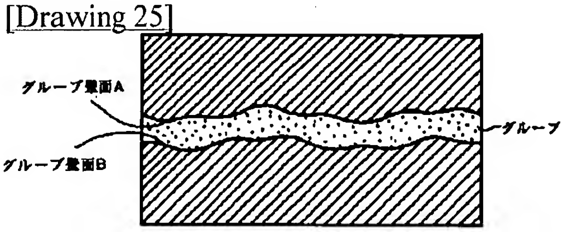

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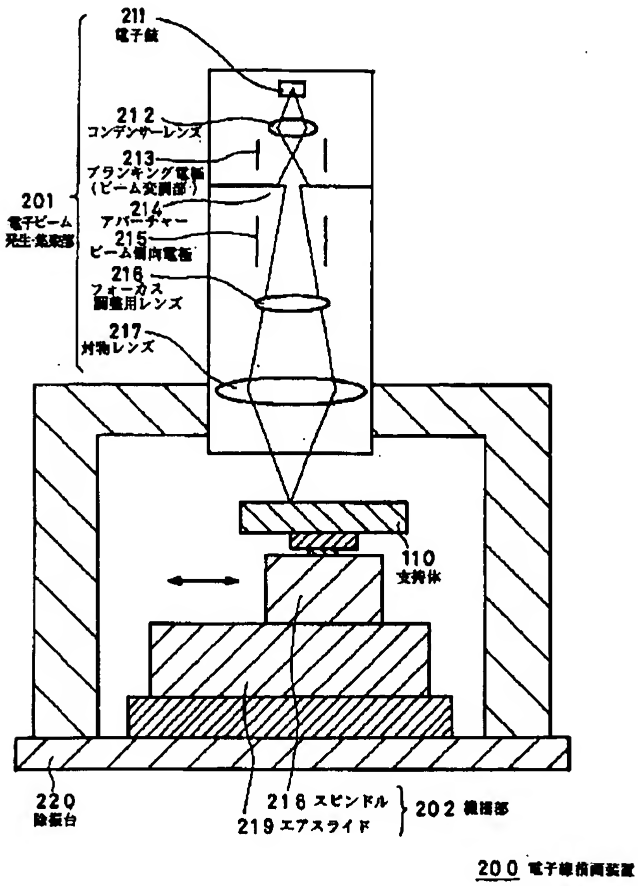

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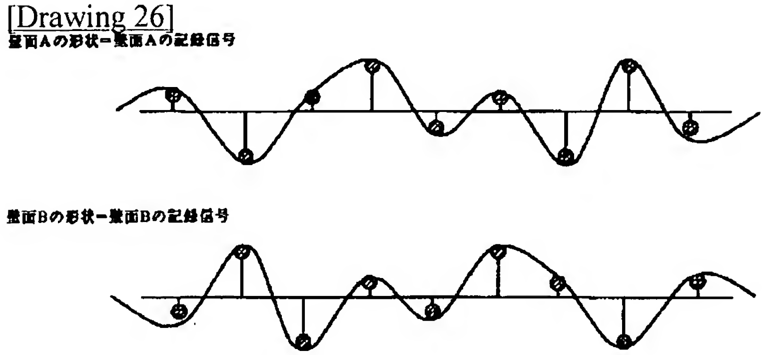

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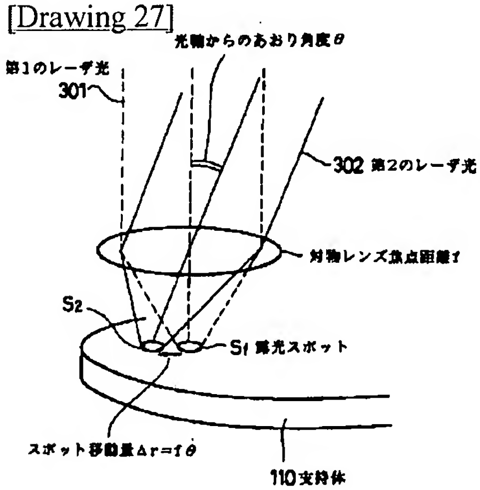

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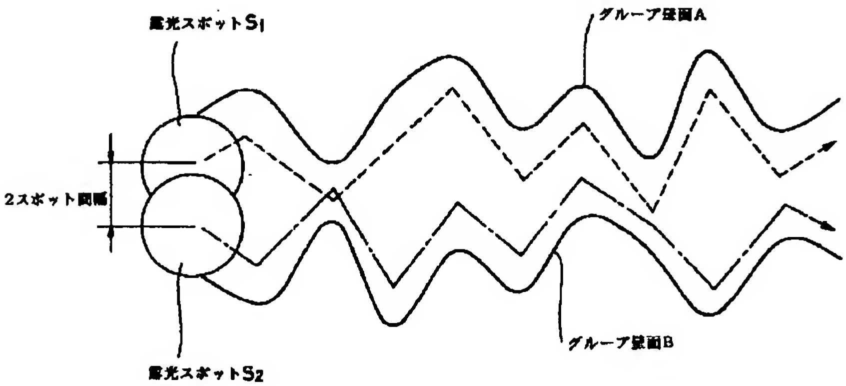

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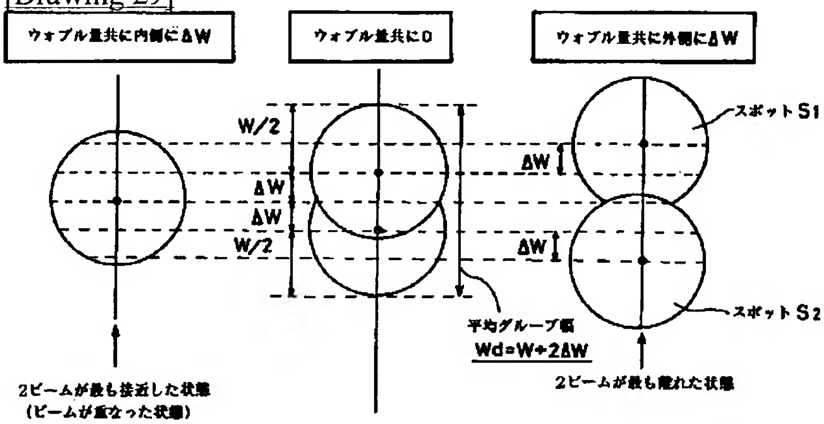
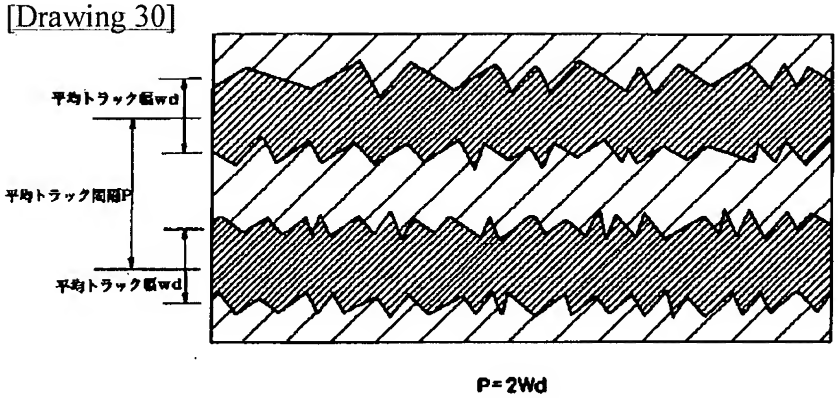


[Drawing 30]



[Translation done.]